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(54) Trails

(57) Method and means of protecting goods or equipment against injurious crawling insects wherein an artificial surface trail for the insects is applied around an area containing said goods or equipment so that the insects can gain access to the area only by crossing the trail, said trail comprising a continuous band of pheromone or pheromone mimic along its length.

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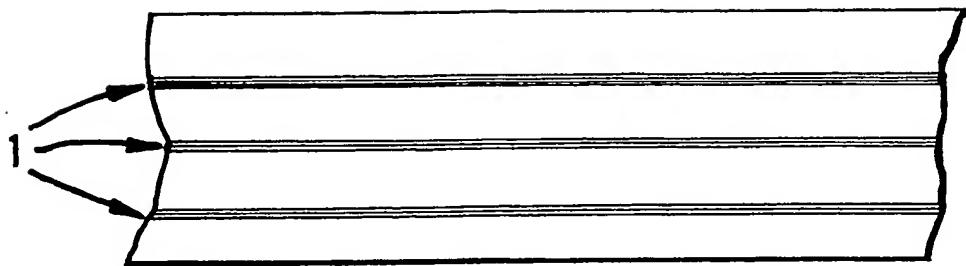
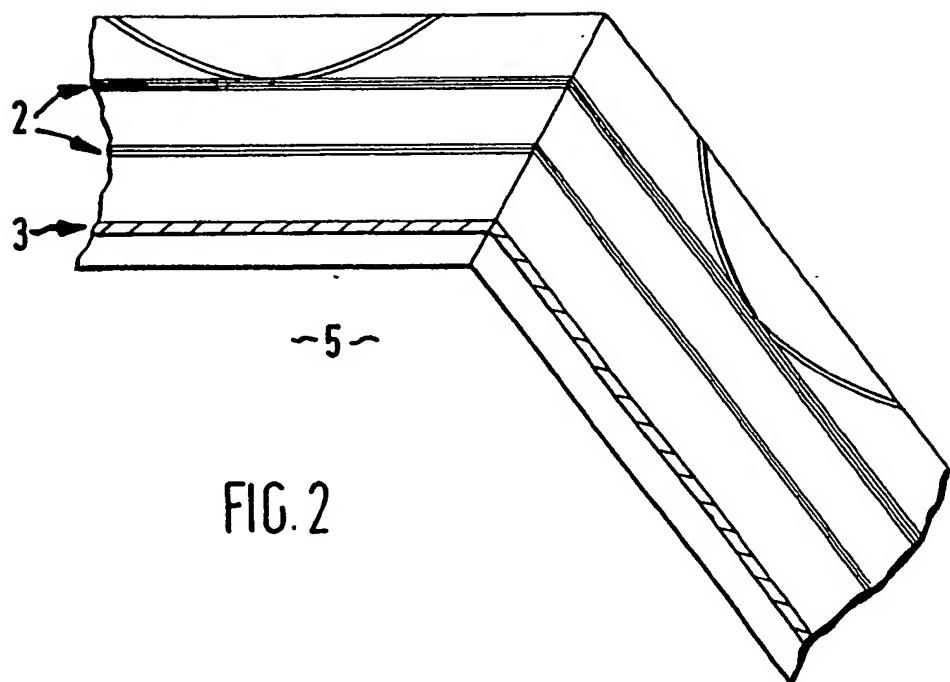


FIG. 1

-4-



-5-

FIG. 2

## SPECIFICATION

## Trails

5 This invention relates to means for mitigating the nuisance and damage caused by certain kinds of insects. 5

The kinds of insect susceptible to control by this invention are those which follow trails laid down by other insects of the same species. The natural utility of such trails to the insects concerned is that they mark paths between, for example, a supply of food and the home or nest 10 of the insect, guiding other members of that nest to the food. 10

It is well known that insect behaviour is often directed or modified by external chemical substances perceived by the insect; these chemical substances are called pheromones if they are emitted by the species concerned. In some cases substances not natural to the species modify insect behaviour and these are usually called lures or mimics. Thus many flying insects use 15 systems of pheromones to enable members of one sex to locate members of the other sex, often 15 over considerable distances.

The kinds of insect which employ trail pheromones are usually crawling insects and especially the social insects such as ants, though in principle a false trail could be laid for flying insects as well. These and other species may additionally follow or explore non-pheromone trails such as 20 those which have a food association for the insect concerned. Where such pests establish 20 themselves in buildings they are objectionable since they will contaminate foods and other goods present. In hospitals and similar establishments such foraging pests may carry pathogenic organisms on their bodies and transmit these organisms for example to operating theatres, to clean dressings and to food handling areas.

25 This invention provides means for reducing the risks presented by such pests. Essentially it consists of a tape or equivalent linear film preformed or formed in situ, bearing one or more 25 artificial trails, which is applied to surfaces so as to form a barrier surrounding either an area which is to be denied to the pest, or alternatively the points of entry of the pest into the premises to be protected. Thus, in order to enter the protected area the insect must cross the 30 trails but as the natural response of the insect on encountering a trail is to follow the trail, it is 30 discouraged from directly crossing into the protected area.

35 Optionally the tape or applied film may comprise in addition to the trail substances, insecticidal substances and/or insect repellent substances. If an appropriate insecticide is incorporated in a tape bearing a trail, individuals following the trail will be subjected to 35 prolonged exposure to that insecticide. If an insect repellent is used it should be included at or near the edge of the tape adjacent to the protected area and that edge should carry distinctive markings so that the person laying the tape can check that it is correctly oriented.

40 Optionally the tape may be self-adhesive. Linear films equivalent to tapes may be painted directly on to surfaces using a conventional drying medium or for example an aerosol, 40 containing the trail substance as such or in an encapsulated form. Similarly trails formed on tapes may be derived from the trail substance per se or a micro-encapsulated form. The exposed surface of a tape or film may be protected by a suitable covering through which the trail substance is capable of diffusing, in order to protect the tape trail from the customary surface cleaning procedures.

45 The trails used may generally be continuous but where a multiplicity of trails are employed 45 those trails adjacent to the pest source area may be designed to redirect the insect back towards that area. It will often be desirable and beneficial to provide conventional baits, i.e. attractive foods containing toxicants, in the area which is not denied to the pests by the trail.

The barrier surrounding the protected area may comprise one or more of the tapes or linear 50 films of this invention. Where two or more tapes are employed these may be separated by a 50 small gap. In such cases only the inner tape, that adjacent to the protected area, should carry an insect repellent.

The invention is illustrated by the following:

Fig. 1 depicts a tape or an applied film with three continuous trails 1. 55

55 Fig. 2 depicts a tape having two trails, 2, and a repellent stripe 3. Area 4 is the unprotected or insect source area and area 5 is the protected area which is to be denied to the pest. The trail stripe adjacent to the unprotected zone is branched so that some pests will return to area 4. By the edge of the tape adjacent to the protected area 5 is a stripe 3 of repellent. This figure also shows how corners should be mitred to ensure that a continuous trail is achieved.

60 Table 1 gives examples of trail substances which have been identified and shown to cause 60 trail following behaviour in the species named.

Table 1

Substance	Insect Affected	
5		5
<i>A. Pheromones</i>		
Methyl 4-methylpyrrole-2-carboxylate	Atta texana (the Texas Leaf Cutting Ant)	
Farnesol	Zootermopsis nevadensis	
10 Faranal	Monomorium pharaonis (Pharaoh's Ant)	10
<i>B Pheromone mimic</i>		
Methyl 4-chloropyrrole-2-carboxylate	Atta texana	
15		15

The amount of active substance required will vary according to the insect species, the chemical nature of the pheromone, the presentation of the pheromone and the desired effective life of the artificial trail. For example the ant, Atta texana, is capable of detecting and responding to as little as  $10^{-11}$  gm/metre of its natural trail pheromone, methyl 4-methylpyrrole-2-carboxylate. It follows that this is the minimum quantity of active substance which must be continuously present on the artificial trail throughout its effective life. In this case the practical total loading of active substance in the artificial trail is between  $10^{-6}$  gm/metre and  $10^{-4}$  gm/metre. Relatively higher loadings are needed when the trail pheromone is volatile or has limited chemical stability. In such cases it will often be advantageous to form the trail using a suitable derivative of the active substance, said derivative being chosen on the basis of its capability of acting as a precursor of the active substance. For example atmospheric oxidation of the aldehyde, faranal, may be delayed by presenting it as the acetal or its bisulphite compound or by intimately mixing it with 10 to 1,000 times its own weight of a sugar. The sugar may be sucrose, glucose, fructose, commercial glucose syrup or honey. In some other cases adequate protection of the active substance and control of its rate of release may be achieved by its encapsulation or the application of a protective film to the prepared trail.

## CLAIMS

35 1. An artificial trail for injurious insects pre-formed for application, or formed in situ, around an area to be protected against insects and comprising a continuous band of pheromone or pheromone mimic along its length. 35

2. An artificial trail according to claim 1 comprising also a toxicant for the insect disposed to be taken up as the insect follows the trail.

40 3. An artificial trail according to claim 1 or claim 2, comprising a separate band of repellent for the insect for application, or applied, adjacent to the area to be protected from it.

4. A method of protecting an area against injurious insects wherein an artificial trail for the insects is applied around the area, said trail comprising a continuous band of pheromone or pheromone mimic along its length and optionally also the toxicant of claim 2 and/or the repellent band of claim 3. 45

## CLAIMS (30 Nov 1982)

50 1. An artificial trail material for injurious crawling insects, formed for application around an area to be protected against the insects, said material carrying a continuous band of pheromone or pheromone mimic along its length. 50

2. An artificial trail material according to claim 1 carrying also a toxicant for the insect, disposed to be taken up as the insect follows the trail.

3. An artificial trail material according to claim 1 or claim 2, carrying further a band, separate from the band of pheromone or mimic, of repellent for the insect.

55 4. An artificial trail material substantially as herein described and shown in the drawings. 55

5. A method of protecting goods or equipment against injurious crawling insects wherein an artificial surface trail for the insects is applied around an area containing said goods or equipment so that the insects can gain access to the area only by crossing the trail, said trail comprising a continuous band of pheromone or pheromone mimic along its length and 60 optionally also (i) a toxicant for the insect, disposed to be taken up as the insect follows the trail, and/or (ii) a band of repellent for the insect separate from the band of pheromone or mimic and lying between it and said area. 60

6. A method of protecting goods or equipment against injurious crawling insects, according to claim 5, substantially as herein described.

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